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Education Attainment in Brazil

THE EXPERIENCE OF FUNDEF

Luiz de Mello, Mombert Hoppe

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EDUCATION ATTAINMENT IN BRAZIL: THE EXPERIENCE OF FUNDEF

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by Luiz de Mello and Mombert Hoppe

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ABSTRACT

For many years, Brazil lagged behind other middle-income countries in terms of school enrolment rates. But since 1998 policies have aimed at bridging this gap, in particular, with the implementation of FUNDEF, a fund for financing sub-national spending on primary and lower-secondary education. Using state- and municipality-level data during 1991-2002, this paper shows that FUNDEF played a key role in the increase in enrolment rates over the period, particularly in small municipalities, which rely more heavily on transfers from higher levels of government as a source of revenue. These findings underscore the importance of FUNDEF in eliminating supply constraints to the improvement of education attainment. Enrolment rates are now nearly universal for primary and lower-secondary education. Emphasis should therefore be placed on policies to improve the quality of services and to remove supply constraints to the expansion of enrolment in upper-secondary and tertiary education.

JEL classification numbers: H52, H72, H77

Keywords: Brazil, education, school enrolment, decentralisation.

RESUME

Pendant de nombreuses années, les taux d'inscription scolaire au Brésil sont restés derrière ceux des pays à revenu moyen. Mais depuis 1998 des politiques ont visé à réduire cet écart, en particulier, avec la mise en place de FUNDEF, un fonds pour financer la dépense de l'éducation du primaire et du premier cycle du secondaire au niveau local. En utilisant des données au niveau des états et des municipalités de 1991 à 2002, cet article montre que FUNDEF a joué un rôle majeur dans l'augmentation des taux d'inscription au cours de la période, en particulier dans les petites municipalités, qui dépendent plus fortement des transferts à partir des niveaux plus élevés d'administration comme source de revenu. Ces résultats soulignent l'importance de FUNDEF en éliminant les contraintes d'offre liées à l'amélioration des résultats d'éducation. Les taux d'inscription sont maintenant presque universels pour l'éducation du primaire et du premier cycle du secondaire. L'accent devrait donc être mis sur des politiques pour améliorer la qualité des services et pour enlever des contraintes d'offre sur l'expansion de l'inscription dans l'enseignement du deuxième cycle du secondaire et du tertiaire.

Classification JEL: H52, H72, H77

Mots-clés: le Brésil, éducation, inscription scolaire, décentralisation.

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EDUCATION ATTAINMENT IN BRAZIL: THE EXPERIENCE OF FUNDEF

Luiz de Mello and Mombert Hoppe,¹

Introduction

1. For many years Brazil lagged behind other middle-income countries in terms of enrolment rates for primary and lower-secondary education. But this is no longer the case. Enrolment rates are now nearly universal, up from less than 85 per cent in the early 1990s. This achievement is due, at least in part, to policies aiming at: *i*) eliminating supply-side constraints, essentially by upgrading the mechanisms for financing sub-national expenditure on education, and *ii*) increasing the demand for schooling, predominantly through the use of school attendance as an additional requirement for enrolment in a host of means-tested income transfers for low-income households. This paper focuses on the possible effects of the former policies on enrolment.

2. The creation of FUNDEF, a fund for financing sub-national spending on primary and lower-secondary education, in 1996, and its subsequent implementation in 1997-98, is emblematic of recent policy efforts to improve education attainment. Through FUNDEF, a national floor was set on a per student basis for government spending on primary and lower-secondary education at all levels of government. The federal government is required to top up spending in those states/municipalities that cannot afford the national spending floor. FUNDEF is believed to have played a leading role in the increase of enrolment rates since 1998, but evidence available to date remains entirely anecdotal. To bridge this gap in the literature, this paper seeks to shed more light on the FUNDEF-enrolment nexus by providing empirical evidence based on both state and municipal data. Moving forward, the paper argues that, having achieved nearly universal enrolment rates for primary and lower-secondary education, more emphasis should be placed on increasing the quality of services and improving access to, while avoiding supply bottlenecks in, upper-secondary and tertiary education.

3. The main findings of this paper underscore the importance of FUNDEF in eliminating supply constraints to the improvement in education attainment. In particular:

- Enrolment rates in primary and lower-secondary education increased at a faster pace after 1998 than before, when FUNDEF was implemented, with FUNDEF-related transfers to the states and municipalities being a key explanatory factor;
- The decentralisation of education has also played a part, with enrolment rates increasing faster in jurisdictions where the municipalities were already more active than the states in service delivery; and
- FUNDEF seems to have a stronger effect on enrolment in small municipalities, measured by the resident population, which typically rely more heavily on transfers from higher levels of government.

1 . The research presented in this paper was conducted in connection with the 2005 *OECD Economic Survey of Brazil*, published under the responsibility of the Secretary General of the OECD. Luiz de Mello is a senior economist at the Economics Department of the OECD and Mombert Hoppe is an economist at the World Bank. The authors are indebted to Andrew Dean, Silvana Malle and Nanno Mulder for helpful comments and discussions; to Anne Legendre, for statistical assistance; and to Muriel Duluc and Lillie Kee, for secretarial assistance.

4. The paper is organised as follows. The following section describes trends in government spending on education and outcomes. Section 3 describes FUNDEF. Section 4 reports the empirical findings using both state-level and municipal data. Section 5 provides some conclusions and policy recommendations.

Trends in public spending, education attainment, and student performance²

5. At close to the OECD average, Brazil already spends a high share of national income on publicly-funded education programmes (Figure 1). Although the 1988 Constitution places the municipalities at the forefront of service delivery for primary and lower-secondary education, the state school network accounted for over 50 per cent of enrolment in the 1990s. This is due to capacity constraints in some parts of the country, reluctance of some municipalities to take full responsibility for service delivery, and, to a certain extent, historical reasons.³

6. Taken together, the states and municipalities account for about two-thirds of public spending on education. Financing comes primarily from earmarked revenue, often through constitutional provisions. To illustrate, all levels of government are required by the Constitution to earmark a share of revenue (18 per cent for the federal government and 25 per cent for the state and municipal governments, including 15 per cent on primary education, in the case of the municipalities) to finance spending on education.

7. Enrolment rates in primary and lower-secondary education have increased at a remarkable pace in recent years (Figure 2). The poorer states seem to be catching up with their better-performing counterparts, although considerable disparities remain across regions. These achievements are consistent with international trends, but in some ways Brazil appears more advanced than several countries with comparable levels of income. At the same time, enrolment rates are expanding in upper-secondary education and have risen rapidly in tertiary education, particularly in private institutions. Still, this is a relatively modest achievement by OECD standards (Figure 3). Several countries have not only higher education attainment rates than Brazil at present but these rates have risen at a faster pace over time. For example, in countries such as South Korea, secondary school attainment among the younger cohorts is not only much higher than in Brazil but also over three times as high as among those aged between 55-64 years, against about one-half in the case of Brazil.

8. Despite the increase in enrolment rates, student performance remains low. Brazil fares poorly in the OECD's PISA measurement of student performance in comparison with countries with similar levels of public spending on education (Figure 4). In reading literacy, Brazil's score is the lowest among the participating countries, although not statistically different from those of Argentina and Chile. Performance levels are lower for mathematics and science.⁴ Discrepancies in performance can be ascribed to differences within and between schools, the latter explaining 43 per cent of the variation in student performance, a value that is close to the OECD average (OECD, 2003).

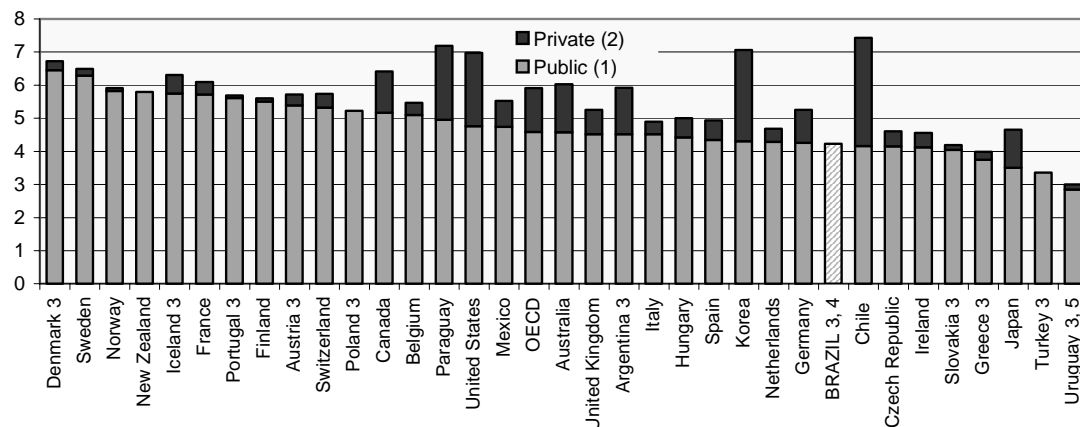
2. See OECD (2005), for more information and discussion on social programmes and expenditure in Brazil.

3. When the first education institutions were founded in the 19th century, the provision of primary and lower-secondary education was assigned to the states, then called provinces. Only in the 1930s was the management and administration of schools extended to the municipalities (Schwartzman, 2003).

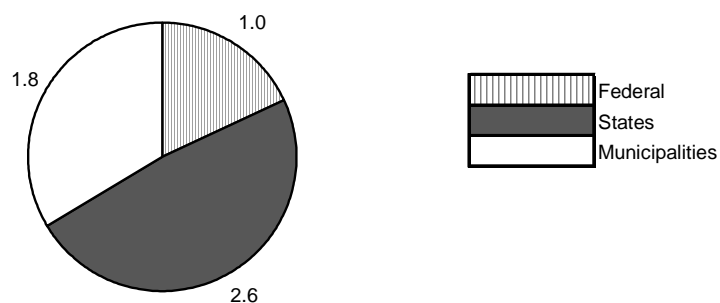
4. In particular, nearly 56 per cent of students are below Level 1, the lowest level of performance, against about 50 per cent in Chile, 44 per cent in Argentina and Mexico, and 80 per cent in Peru. Less than 1 per cent of students reached the top level of performance, compared to an OECD average of about 10 per cent. See OECD (2003), for more information.

Figure 1. **Public spending on education**
In per cent of GDP

A. Expenditure on educational institutions, 2000



B. Composition of education spending across levels of government⁶



1. Includes transfers to households assigned to educational institutions, and direct expenditure on educational institutions from international sources.

2. Net of government transfers to educational institutions.

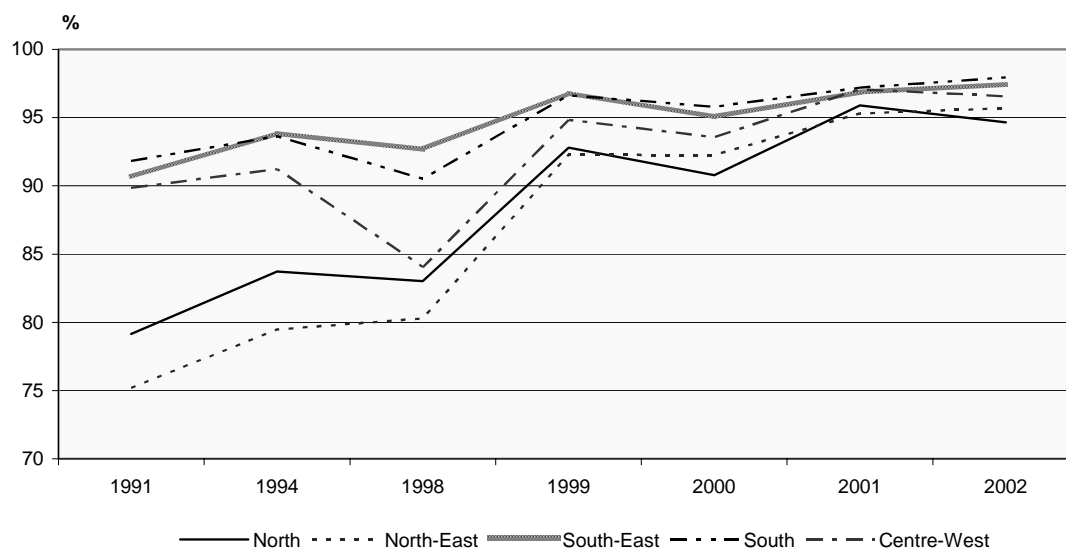
3. Transfers to households not included in public expenditure, but in private expenditure.

4. Direct expenditure on tertiary educational institutions from international sources exceeds 1.5 per cent of public expenditure. International sources at primary and secondary level exceed 1.5 per cent in Uruguay.

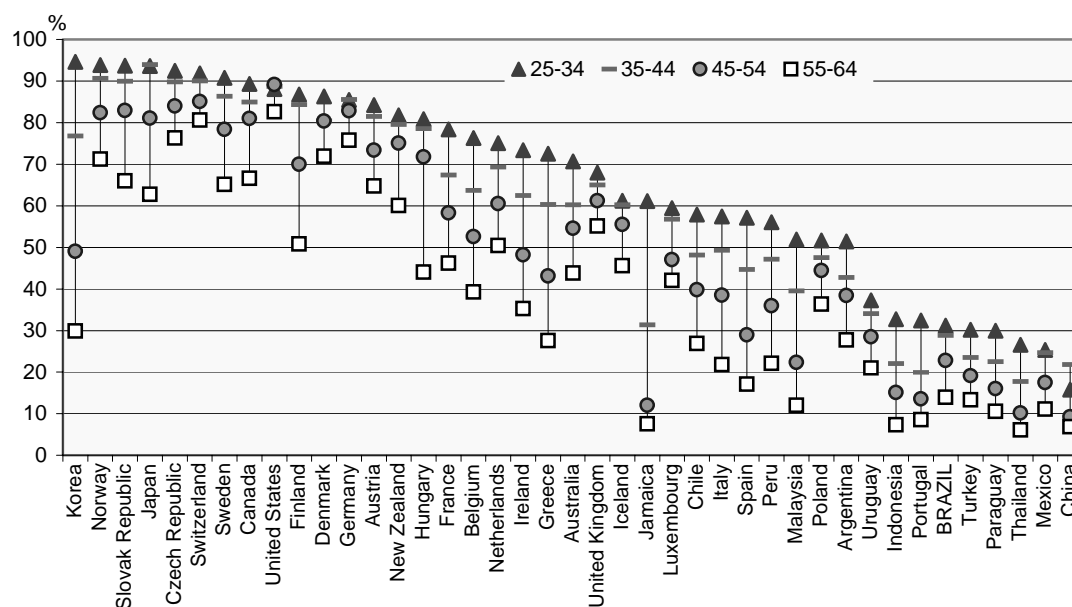
5. Post-secondary non-tertiary education included in tertiary education.

6. The numbers refer to spending levels in per cent of GDP.

Source: OECD, *Education at a Glance*; Reis and Rocha (2004); and Ministry of Finance.

Figure 2. **Net enrolment rates: primary and lower-secondary education, 1991-2002**

Source: Ministry of education and OECD calculations.

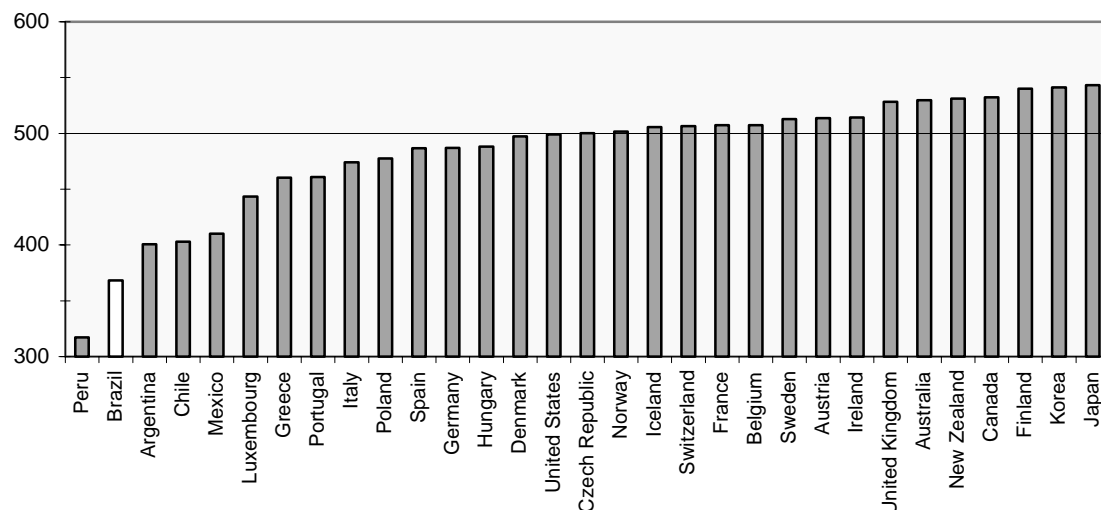
Figure 3. **Secondary school attainment by age cohort, 2001¹**

1. Percentage of the population in each cohort that has attained at least upper-secondary education. The reference year for non-OECD countries is 2000.

Source: OECD, *Education at a Glance*.

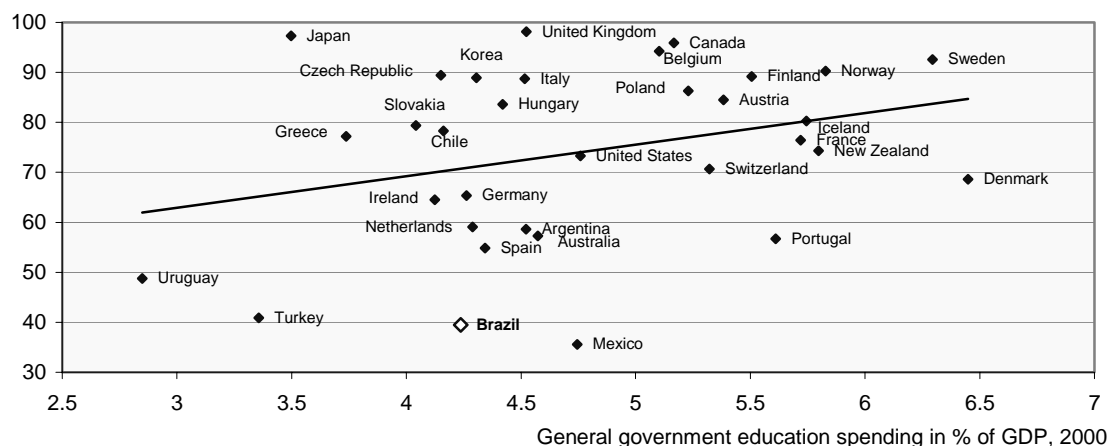
Figure 4. Public spending, enrolment and performance

A. Student performance: PISA+ scores, 2000



B. Public spending and outcomes

Net enrolment rate in upper secondary education, 2002

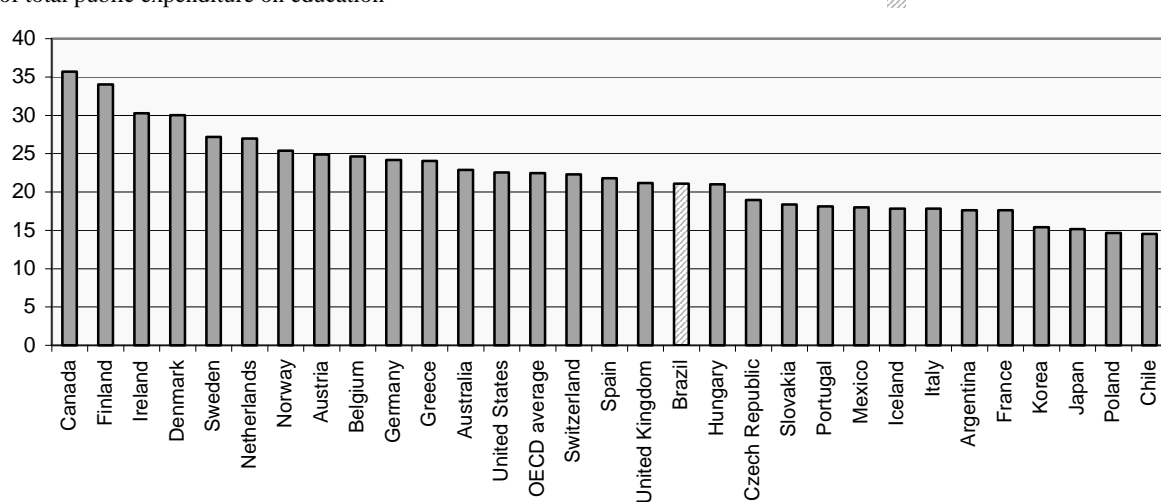
Source : OECD, *Education at a Glance*.

9. Against a backdrop of relatively high spending-to-GDP ratios, low performance may indicate a quality problem. International comparisons show that some countries achieve better social outcomes than Brazil for the same level of, or less, public spending. This suggests that these better performers may spend more than Brazil on social programmes on a cumulative basis, having had higher spending levels for longer periods of time. But these discrepancies may also reflect an efficiency gap. In this respect, empirical evidence suggests that the quality, rather than the level, of public spending is a more powerful determinant of performance. Also, differences in income per capita tend to explain most of the discrepancies across countries in enrolment rates, with cross-country differences in the volume of resources spent by the government on these programmes being a less important explanatory factor (Flug, Spilimbergo, and Watchenheim, 1998; Baldacci, Guin-Siu, and de Mello, 2002).

Figure 5. **Public spending on tertiary education**
In per cent of GDP

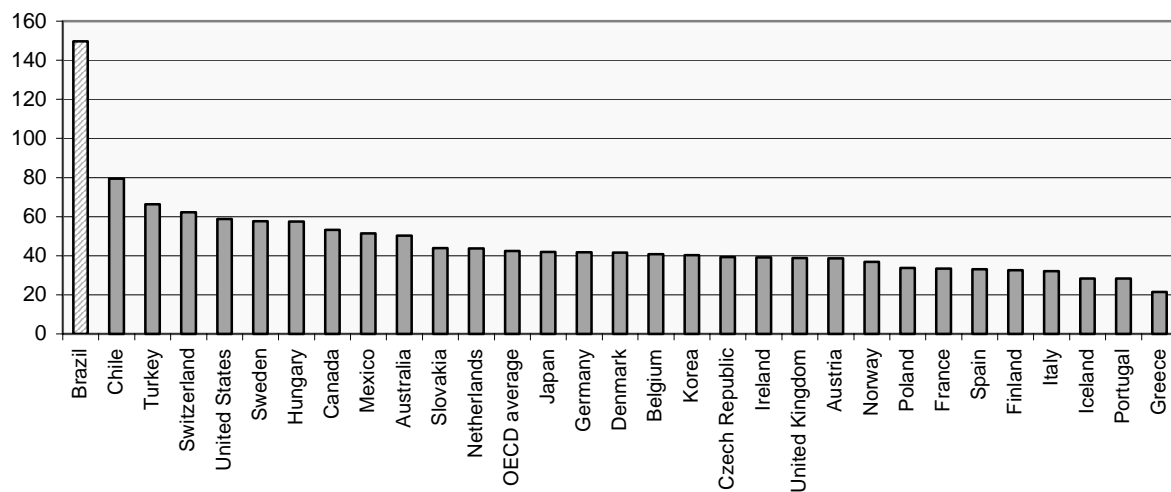
A. Public expenditure on tertiary education

% of total public expenditure on education



B. Expenditure per student on tertiary education institutions

% of GDP per capita



Source : OECD, *Education at a Glance*.

10. Likewise, the extent to which public outlays is targeted to the intended population is known to affect the link between spending levels and outcomes. Public spending that favours tertiary education relative to primary education tends to be less effective at improving the education status of the population as a whole than when emphasis is placed on primary education. In the case of Brazil, the composition of government spending is skewed towards higher education, the benefits of which accruing predominantly to the better-off. Tertiary education accounts for about one-fifth of government spending on education, close to the OECD average (Figure 5). But the average cost to the budget of higher education per student is about 150 per cent of GDP per capita, almost four times as high as the OECD average.

FUNDEF: Reforming the arrangements for financing public spending on education

11. FUNDEF (*Fundo de Manutenção e Desenvolvimento do Ensino Fundamental e de Valorização do Magistério*) was created in 1996 and implemented in January 1998 in most states (with the exception of the state of Pará, where it was already implemented in July 1997). FUNDEF changed the mechanism for financing sub-national spending on education in two main ways. *First*, it introduced a national spending floor per student enrolled in primary (1st to 4th grades) and lower-secondary (5th to 8th grades) education, coupled with a framework for the allocation of funds between the state and municipal public school networks. *Second*, it requires the federal government to top up spending in those jurisdictions that cannot afford the national spending floor. Since 2000, different floors have been set for lower-secondary education at 5 per cent above the value for primary education.

12. FUNDEF relies on earmarked revenue. The Fund is made up of 15 per cent of *i*) the state and municipal allocations in the revenue-sharing funds with the federal government (*Fundo de Participação dos Estados*, FPE, and *Fundo de Participação dos Municípios*, FPM), *ii*) revenue from the state value-added tax (ICMS), *iii*) revenue from the federal value-added tax levied on exports (IPIexp), and *iv*) federal transfers to the states in compensation for the revenue losses associated with the exemption of exports of primary and semi-manufactured from value added (ICMS) taxation (originally known as *Lei Kandir*, Complementary Law No. 87 of 1996).

13. FUNDEF resources are allocated within each state according to the number of students enrolled in the state and municipal public school networks. At least 60 per cent of FUNDEF allocations must be spent on teacher's compensation and the remaining share, on operations and maintenance. Both categories of spending are specified in a detailed manner to avoid misclassification. This is important in the light of anecdotal evidence that earmarked funds have often been allocated to projects purported to deal with, but with no immediate relation to, education (Ministry of Education, 2002). Likewise, richer municipalities in more developed regions have often been reported to re-direct funds for primary and lower-secondary education towards upper-secondary and tertiary education. In addition, councils (*Conselhos de Acompanhamento e Controle Social do FUNDEF*) have been created to enhance social control over the use of FUNDEF resources. The need for more detailed, high-frequency information on school enrolment and the share of enrolment between the state and municipal school networks has also motivated the upgrading of statistics on education through the implementation of annual "school censuses".⁵

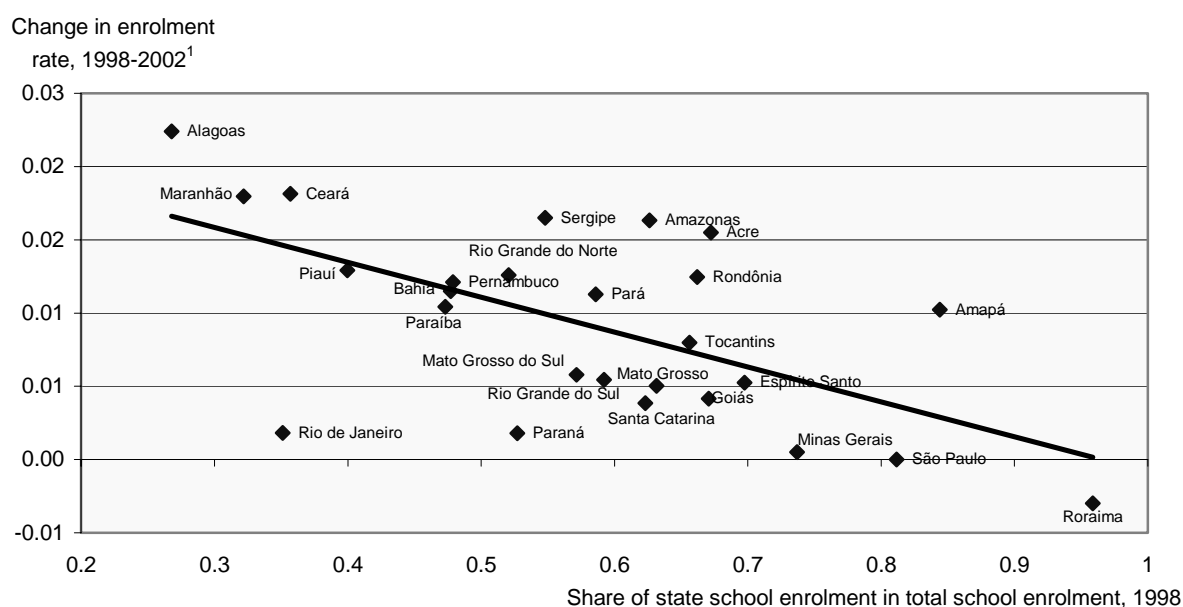
14. FUNDEF transfers have become an important source of finance for the municipalities. The value of transfers per student has increased in real terms during 1998-2002, although differences among the states remain sizeable, reflecting primarily their revenue raising capacity (Appendix Table 1). At the same time, federal spending on top-up grants declined from 3.7 per cent of total funds in 1998 to 1.8 per cent in

5. Schools are required to submit information on the number of students that are enrolled and effectively attending school at the end of March of the reference year. Stricter enforcement of compulsory schooling has been found to be a powerful determinant of secondary school enrolment rates in the United States in the first half of the 20th century (Goldin and Katz, 2003).

2002 (Appendix Table 2). The number of recipient states fell from 8 to 5 in the period. Although the share in municipal revenue of transfers from higher levels of government remained roughly constant, the share of FUNDEF resources in total transfers increased during 1998-2003 (Appendix Table 3). Smaller municipalities tend to rely more heavily on FUNDEF as a source of revenue.

15. Although the increase in enrolment rates after 1998 cannot be attributed solely to FUNDEF, there appears to be a strong association between increases in enrolment rates and the extent of decentralisation (Figure 6), measured by the composition of enrolment between the state and municipal school networks.⁶ The sharing of FUNDEF resources according to the number of students actually enrolled provides an incentive for the expansion of the municipal school network, thus fostering decentralisation.⁷

Figure 6. Enrolment rates and composition of school networks



1. Average annual per cent change in net enrolment rate during 1998-2000.

Source: Ministry of education and OECD calculations.

6. Law 9 394 of 1996 created a National Education Council and called for the elaboration of a national education plan, which was adopted in 2001. Subsequently, cooperation was enhanced between the National Education Council and state and municipal councils to facilitate the implementation of decentralisation, on which emphasis had been put in the 1988 Constitution.

7. To illustrate, Occhiuze dos Santos (undated) underscores the importance of FUNDEF in the process of decentralisation of education in the state of São Paulo.

Empirical analysis

State-level regressions

16. The hypothesis to be tested is that the implementation of FUNDEF has had a significant impact on net enrolment rates. To do so, rather than estimating a structural system of supply and demand equations for primary and lower-secondary education, a more general reduced-form equation is preferred. The choice of control variables is guided by the literature, including Hedges *et al.* (1994), Hanushek (1995), Kremer (1995), Handa (2002), and Baldacci *et al.* (2002).⁸ The estimating equation is as follows:

$$(1) \Delta E_{is,t} = \alpha_0 + \alpha_1 \log(E_{it}) + \alpha_2 \log(gdp_{it}) + \alpha_3 rep_{it} + \alpha_4 \Delta education_{it} + \alpha_5 FUNDEF_{it} + \varepsilon_{it},$$

where:

$\Delta E_{is,t} = (E_{is} / E_{it})^{1/(s-t)} - 1$ is the rate of change in net enrolment rate E_i from time t to time s in state i ;

Error! Objects cannot be created from editing field codes. is per capita GDP of state i at time t ;

rep_{it} is the repetition rate in state i at time t ;

$\Delta education = (education_{it} / education_{it})^{1/(u-t)} - 1$ is the change in real municipal spending on education and culture;

FUNDEF is a set of indicators comprising: $fundef_{it}$, a dummy variable taking the value of “1” from 1998 onwards, and “0” otherwise; $coefficient_{it}$ is the share of students enrolled in the state, rather than municipal, school network; $\Delta student_{it} = (student_t / student_{t-1}) - 1$ is the change in FUNDEF transfers per student in state i ; $trval$ is the value of the federal top-up grant per student; and $trdum$ is a dummy variable identifying the years in which a given state i received a federal top-up grant;

and ε_{it} is an error term.

17. We expect E_{it} to enter the equation with a negative coefficient, indicating a process of catch-up in enrolment rates. GDP per capita is expected to be positively signed, being a proxy for income effects and controlling for the state’s capacity to finance the provision of education services. The growth rate of spending on education and culture is expected to be positively signed. The repetition rate proxies for differences in quality of schooling among the states and is expected to be negatively signed. We use data for all Brazilian states (excluding the Federal District) for 1991, 1994, and 1998-2001. The data set is described in more detail in Appendix 2 and descriptive statistics are presented in Appendix Table 4.

18. A few comments on the choice of explanatory and control variables are noteworthy. *First*, Equation (1) is clearly supply-oriented, which is due to data constraints. Per capita GDP is the only demand-side variable among the regressors. This is consistent with recent empirical evidence based on household survey data that in developing countries income tends to be a stronger determinant of the

8. Colclough and Al-Samarrai (2000) use the ratio of public current expenditure on primary education to GNP, the share of school age children in the population, primary education unit costs per child, and proxies for quality (such as the repetition rate) in their analysis of gross enrolment rates.

demand for schooling than returns to education (Glewwe and Jacoby, 2004). Information on other conventional demand-side variables, such as income distribution indicators, is not available on an annual basis or these variables do not exhibit enough variation over time. *Second*, information is not readily available on the number of recipients of income transfer programmes in each state over the period of analysis. This would be a better control for policies using school enrolment as a requirement for receipt of means-tested income transfers, such as *Bolsa-Escola* (now part of *Bolsa-Família*). These policies affect school enrolment through demand-side channels, which are independent of the implementation of FUNDEF.⁹ *Finally*, information on a variety of quality indicators, such as pupil-teacher ratios and class sizes, is not available for each state over the whole period of analysis.

The results

19. The baseline results are reported in Table 1. The null hypothesis of zero variance of state specific error terms cannot be rejected. Therefore, all models are estimated by random effects. In all specifications, the initial level of enrolment is strongly significant and has the expected negative sign, indicating conditional convergence in enrolment rates among the states. Using the coefficient estimated in Model 1, a state with an enrolment rate of 60 per cent would catch up with a state with enrolment rate of 95 per cent in about 8 years. The growth rate of municipal public spending on education and culture is positively signed and strongly significant in all models, as expected. The other baseline controls are less robust. Per capita GDP has the expected positive sign but is not statistically significant at classical levels in all model specifications. The repetition rate is negatively signed but statistically significant only at the 15 per cent level and in some model specifications. Due to data constraints, discussed above, it was not possible to experiment with other proxies for quality and demand-side variables to test the robustness of the baseline regression.

20. The empirical findings support the hypothesis that FUNDEF is associated with an increase in enrolment rates (Models 2-4). The dummy variable *trdum* is statistically significant and carries the expected positive sign. The introduction of the *fundef* dummy increases the significance of three of the four controls, and the dummy variable itself is statistically significant and positively signed, as expected. This result for *fundef* is confirmed when including both dummies in Model 4, although *trdum* loses significance while remaining positively signed. Also, we cannot reject the null hypothesis that the growth rates of enrolment are different before and after the introduction of FUNDEF. Enrolment rates rose by about 2 ½ per cent per year faster after 1998 relative to the average growth rate during 1991-1998.¹⁰

21. In Models 5-8, we include *coefficient* among the regressors. The variable is not statistically significant at classical levels in Models 5-6. As data are not available for 1994, we effectively drop this time period. Still, the significance of the other variables is generally stronger than in Model 1. Model 7 is our preferred specification, which includes $\Delta student$ among the regressors. The variable is strongly significant and positively signed, indicating that the higher the increase in FUNDEF transfers, the higher the growth rate in enrolment. Finally, we include *trval* in Model 8 to test for the effect of federal top-up grants. Nevertheless, while *trval* is positively signed, it is not statistically significant at classical levels.

9. Schultz (2004) estimates the impact of Mexico's *Progres*a programme, which is similar to Brazil's *Bolsa Escola/Bolsa Família*, on school enrolment using household survey data. The author finds that enrolment rates of comparably poor children are higher in the areas where *Progres*a was in place than in non-*Progres*a localities.

10. Running separate regressions using dummies for each year confirms this result. While the growth rate in enrolment from 1999 to 2000 was not statistically different from that observed in the period before 1998, the dummies for the other three time periods are strongly significant, positive, and vary over time, indicating that growth rates in enrolment have been higher after 1998 than before.

Table 1. **FUNDEF and enrolment rates: state-level regressions**
 Dep. Var.: Change in net enrolment rate in primary and lower-secondary education (in per cent)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Enrollment rate (log)	-0.255 (6.93)	*** (7.31)	*** (8.43)	*** (8.47)	*** (8.51)	*** (6.76)	*** (7.31)	*** (7.28)
Per capita GDP (log)	0.001 (0.22)	0.005 (1.06)	0.007 (1.58)	0.009 (1.80)	* (2.07)	* (1.77)	0.009 (1.49)	* (1.65)
Repetition rate	-0.0003 (0.91)	-0.0004 (1.23)	-1E-04 (0.06)	-2E-05 (0.26)	-0.001 (1.98)	-0.001 (1.66)	-0.001 (1.85)	* (1.83)
Change in spending on education	0.017 (3.70)	*** (3.71)	*** (4.73)	*** (4.63)	*** (4.43)	*** (3.70)	*** (3.59)	*** (3.49)
FUNDEF indicators								
<i>trdum</i>		0.01 (2.04)	**	0.005 (0.94)				
<i>fundef</i>			0.024 (4.13)	*** (3.65)	0.022 (3.65)			
<i>coefficient</i>					-0.022 (1.56)	-0.024 (1.32)	-0.038 (2.00)	* (1.71)
<i>?student</i>							0.092 (2.28)	** (2.38)
<i>trval</i>								0.087 (0.71)
Intercept	1.159 (6.57)	*** (6.92)	*** (8.08)	*** (8.11)	*** (8.30)	*** (6.57)	*** (7.14)	*** (7.14)
No. observations	130	130	130	130	104	78	78	78
Number of states	26	26	26	26	26	26	26	26

All regressions are estimated by random effects. Absolute values of *z* statistics are reported in parentheses. Statistical significance at the 1, 5, and 10 per cent levels is indicated by ***, **, and *, respectively. The sample spans the period 1991, 1994, 1998-2001.
 Source: OECD calculations.

The municipality-level regressions

22. It is not possible to run enrolment equations using municipal data identical to those estimated for the states. But it is important to shed more light on the FUNDEF-enrolment nexus using available data for the municipalities. A data set for at most 5 506 municipalities in 1991 and 1998-2000 was therefore constructed for this purpose. Again, the choice of variables was guided primarily by data availability.

23. A few adaptations were required. To proxy for quality, the repetition rate (for which municipal data are not readily available), was replaced by the share of people living in households with access to electricity in 2000, $elec_i^{2000}$. This variable controls for “rurality”, and hence the quality of education, which tends to be lower in rural communities. Moreover, the initial Gini coefficient ($gini_i^{1991}$) was included among the regressors to control for demand-side effects, and $\Delta education$ was replaced by the level of municipal spending on education and culture in 2000 ($education^{2000}$) because data for 1991 are not reliable. Per capita GDP was dropped due, again, to data reliability.

24. The estimating equation is as follows:

$$(2) \Delta E_i^{1991-2000} = \beta_0 + \beta_1 \log(E_i^{1991}) + \beta_2 elec_i^{2000} + \beta_3 gini_i^{1991} + \beta_4 education_i^{2000} + \beta_5 FUNDEF_{it} + \varepsilon$$

where:

$$\Delta E_i^{1991-2000} = E_i^{2000} / E_i^{1991} - 1, \text{ with } E_i^t \text{ denoting the enrolment rate in municipality } i \text{ at time } t; \text{ and}$$

FUNDEF is a vector including *i*) the share of students enrolled in the state school network, *ii*) the value of transfers to municipality *i* under FUNDEF (1998-2000 average).

25. As in the state-level equations, we expect a catch-up effect and therefore a negative coefficient for E_i^{1991} . The share of students enrolled in the state school network is expected to be negatively signed, while the value of transfers under FUNDEF should be positively signed.

The results

26. Estimation of Equation (2) confirms the findings using state-level data (Table 2). Initial enrolment (E_i^{1991}) is negatively signed in all models, confirming the catch-up effect in enrolment rates. As expected, there appears to be a negative relationship between the Gini coefficient and the growth rate of enrolment, possibly due to the fact that income inequality makes access to services more difficult for low-income individuals.¹¹ Access to electricity is positively signed and statistically significant. This is consistent with Birdsall's (1985) analysis of average years of schooling based on the 1970 census, suggesting that school enrolment was determined predominantly by supply-side effects, particularly in urban areas. Schultz (2004) also finds that rurality is negatively correlated with enrolment in Mexico. As expected, increased spending per student has a positive effect on the growth rate of enrolment.

11 . Colclough and Al-Samarrai (2000) find that the removal of school fees in Malawi had a significant positive effect on (gross) enrolment rates during 1990-95.

Table 2. **FUNDEF and enrolment rates: municipality-level regressions**
 Dep. Var.: Percentage change in net enrolment rate during 1991-2000

	(1)	(2)	(3)	(4)
Enrolment rate in 1991 (log)	-1.343 (81.34)	*** (80.32)	*** (78.20)	*** (77.93)
Gini coefficient (1991)	-0.103 (6.02)	*** (5.88)	*** (5.74)	*** (5.74)
Access to electricity (2000)	0.001 (4.85)	*** (4.64)	*** (4.61)	*** (4.59)
Spending per student (log)	0.018 (9.80)	*** (13.86)	*** (11.99)	*** (10.64)
Composition of school network		-0.069 (8.96)	*** (10.00)	*** (9.71)
FUNDEF transfer (log)			0.021 (4.54)	***
Interactions between FUNDEF transfers and municipality size				
Transfer*small municipalities (less than 5,000 inhabitants)				0.022 (4.73)
Transfer*small/medium municipalities (5,000-9,999 inhabitants)				0.021 (4.47)
Transfer*large/medium municipalities (10,000-19,999 inhabitants)				0.021 (4.65)
Transfer*large municipalities (above 20,000 inhabitants)				0.022 (4.73)
Intercept	5.944 (101.37)	*** (99.57)	*** (108.20)	*** (106.39)
Observations	4,305	4,305	4,305	4,305
R-squared	0.94	0.94	0.94	0.95

All regressions have been estimated by OLS. Robust *t* statistics are reported in parentheses. Statistical significance at the 1, 5, and 10 per cent levels is indicated by ***, **, and *, respectively.

Source : OECD calculations.

27. The FUNDEF-specific variables are also signed as expected. Enrolment grew faster during 1991-2000 in the municipalities where the state school network was smaller (Model 2), suggesting that decentralisation encourages enrolment. Moreover, the FUNDEF transfers had a positive impact on the evolution of enrolment over the period of analysis (Model 3).

28. Smaller municipalities rely more heavily on transfers from higher levels of government, including those associated with FUNDEF, as a source of revenue. As a result, the hypothesis that the FUNDEF-enrolment nexus is affected by municipality size was also tested.¹² To do so, we included in the regressions interaction terms between dummies identifying the size of the municipality and the value of FUNDEF transfers. The municipalities were divided into 4 separate groups depending on population. The results, also reported in Table 2, suggest that the implementation of FUNDEF was associated with a more rapid increase in enrolment rates in smaller jurisdictions (Model 4). The null hypothesis that the coefficients for each sub-group are equal is rejected at the 1 per cent level of significance for all pair-wise comparisons, except for the group of medium/large municipalities (*i.e.*, those with resident population between 10 000 and 19 999 inhabitants), whose coefficient is statistically indistinguishable from that of small/medium municipalities (*i.e.*, those with resident population between 5 000 and 9 999 inhabitants). These findings suggest that the small and large municipalities have benefited more, albeit by a small amount, from FUNDEF transfers than small/medium and large/medium municipalities.

29. These results are robust to the inclusion in the data set of the municipalities with spending per student below BRL 300. The coefficient on spending per student falls slightly, while the coefficients on transfers under FUNDEF increase in magnitude. The coefficients of the interaction terms are also robust to the use of the full data set. Likewise, the inclusion of outlying observations for the rate of growth of enrolment does not affect the results qualitatively. Neither does the re-estimation of Equation (2) for the level of enrolment in 2000, rather than its rate of growth during 1991-2000. The findings (not reported but available upon request) suggest that the level of enrolment in 1991, entering the model in log form, is a powerful determinant of enrolment in 2000, as expected. The hypothesis that the FUNDEF-enrolment nexus is relatively more important for the smaller municipalities is also confirmed.

Enrolment versus quality: a comment

30. It is relatively soon to assess the impact of FUNDEF on the quality of education, which remains on average below the level considered satisfactory by the Brazilian authorities, while recognising that an increase in enrolment rates does not necessarily imply an increase in quality (Ministry of Education, 2003b). Among indicators that would point to an increase in quality over time are the reduction over time in drop-out rates (from 35.9 to 27.7 per cent during 1999-2002) and average class size (from 36 to 33.9 students during 1999-2003), as well as repetition rates and grade-age gaps. Performance in primary education is also believed to have increased since 2001 (Ministry of Education, 2003b).¹³

31. Although these outcomes cannot be attributed exclusively to FUNDEF, it should be noted that current policies already contribute to boosting quality in the years to come. The fact that 60 per cent of the resources disbursed through FUNDEF are earmarked for teachers' compensation can be seen as a step in

12. For the dataset as a whole, the mean resident population is 33 675 with a standard deviation of 207 382, six times the mean. In comparison, the mean resident population in the state-level dataset is 6.5 million while the standard deviation is only 1.2 times as large.

13. Analysing these developments for the two school-infrastructure providers, the state and municipalities, it appears as if the quality improvements have actually been larger in the state-system. This might be the result of the enrolment shift from the state to the municipal level. Decreasing the number of students in a system is likely to improve conditions and therefore quality. For the rapidly expanding municipal system, the adverse effect is likely to be observed during the period of expansion.

the right direction. On average, teachers' remuneration increased by 38 per cent between December 1997 and June 2001, outstripping inflation (Ministry of Education, 2002). Moreover, since 2002, compensation for non-certified teachers can no longer be financed through the 60 per cent share of revenue earmarked for teacher compensation, leading to a shift in demand for teachers with better qualification. In this regard, the evidence reported by Birdsall (1985) suggests that the educational attainment of teachers had a significant impact on average schooling years in 1970s. This is also consistent with international experience, discussed by Hanushek (1995). Better remuneration increases the attractiveness of being a teacher, particularly in rural areas, as the rural/urban wage differential should slowly decrease, thereby drawing more people into the profession and, expectedly, increasing quality over time. According to the World Bank (2003), the remuneration gap between municipal and state schools has already started to close. Recent policies, such as the FUNDESCOLA programme, already focus on increasing the rate of students attaining primary schooling, increasing quality, setting minimum standards, and substituting uncertified by certified teachers.

Conclusion

32. The empirical evidence reported in this paper suggests that the implementation of FUNDEF in 1997-98 contributed significantly to the rapid increase in enrolment rates in primary and lower-secondary education thereafter. Based on state-level data and controlling for other supply- and demand-side determinants of school enrolment, the increase in FUNDEF transfers to finance sub-national service delivery was found to have a positive effect on actual enrolment rates, rather than just an expansion of the school network. Decentralisation was also found to encourage enrolment: the lower the proportion of students enrolled in the state, rather than the municipal, school network, the faster the increase in enrolment. Extending the empirical analysis to the municipal level confirms the results of the state-level regressions. In addition, FUNDEF transfers are particularly effective in increasing enrolment rates in small municipalities, which can be attributed to their greater reliance on transfers as a source of revenue. These findings underscore the importance of FUNDEF in eliminating supply constraints to the improvement in education attainment.¹⁴

33. As enrolment rates are already close to universal, the focus of policies should now be shifted towards improving the quality of, rather than simply access to, primary and lower-secondary education, and removing supply bottlenecks in upper-secondary education. Against a backdrop of high spending on tertiary education, further reform in this area would be welcome, particularly if aimed at improving cost recovery. Recent policy discussions include the extension of FUNDEF to upper-secondary education. The possibility of including pre-school education among the services to be financed through this extended fund is also being discussed. An extension of FUNDEF would nevertheless require additional sources of finance. This could be achieved by increasing the earmarking of revenues that currently make up FUNDEF, although the merits of this funding mechanism should be carefully assessed. Widespread earmarking, and the introduction over the years of minimum spending requirements for several programmes, especially in the social area, have severely curtailed budget flexibility at all levels of government. The merits of these expenditure rigidities are yet to be evaluated against the attainment of their intended policy objectives.

14. The results reported by Foster and Rosenzweig (2004) based on household survey data for India also suggest a supply side effect on school enrolment during the Green Revolution. In that period, schools tended to be built in areas with higher levels of productivity growth. By distinguishing landed and landless households, and estimating that technological change encouraged school enrolment in landed, but not in landless, households, the authors find that school building tended to offset the adverse effect of agricultural technological change on the distribution of income between the two types of household.

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APPENDIX 1

Appendix Table 1. **Minimum spending per student under FUNDEF**
(in *reais* of 2000)

	1998	2000	2002	Change between 1998-02 (in per cent)
Acre	695	738	902	29.8
Alagoas	385	352	384	-0.1
Amazonas	487	493	549	12.8
Amapá	790	798	1,002	26.8
Bahia	361	332	362	0.3
Ceará	361	343	379	5.1
Espírito Santo	530	606	670	26.5
Goiás	396	445	552	39.4
Maranhão	361	332	356	-1.3
Minas Gerais	406	452	525	29.5
Mato Grosso do Sul	419	521	593	41.6
Mato Grosso	482	547	612	26.9
Pará	361	333	356	-1.4
Paraíba	369	345	414	12.3
Pernambuco	359	341	393	9.5
Piauí	350	330	365	4.2
Paraná	479	573	664	38.6
Rio de Janeiro	709	668	711	0.4
Rio Grande do Norte	396	442	526	32.6
Rondônia	444	525	589	32.4
Roraima	1,032	1,014	1,281	24.1
Rio Grande do Sul	643	698	793	23.4
Santa Catarina	546	620	731	34.0
Sergipe	452	485	597	32.2
São Paulo	753	887	973	29.2
Tocantins	439	477	729	66.3
Unweighted average	500	527	616	22.1

Source: Ministry of Education.

Appendix Table 2. **FUNDEF: Financial indicators, 1998-2004**
In millions of *reais* , unless otherwise indicated

	1998	2000	2002	2004 (est.)
FUNDEF resources	13,274	17,605	22,951	27,859
Federal top-up grants	435	488	422	380
<i>Memorandum items:</i>				
Federal top-up grants (in per cent of FUNDEF resources)	3.7	2.8	1.8	1.4
States receiving federal top-up grants:				
Alagoas	1.3	4.2	...	4.8
Bahia	112.3	181.1	173.9	34.3
Ceará	48.2	20.3	...	...
Maranhão	130.5	157.5	148.4	207.9
Pará	107.4	90.1	71.7	108.9
Paraíba	3.2	3.8	...	...
Pernambuco	10.5	1.5	...	...
Piauí	21.4	29.5	27.8	23.8

Source : Ministry of Education (2003c), Ministry of Education, and OECD calculations.

Appendix Table 3. **FUNDEF and municipal finances, 1998-2003**

Municipality size (resident population)		FUNDEF transfers				Allocation of FUNDEF resources (in per cent)		Share of transfers in total revenue	
		In per cent of total transfers		In per cent of total revenue		1998	2003	1998	2003
		1998	2003	1998	2003				
Category									
Large	Above 1,000,000	9.7	13.5	4.5	6.5	26.2	21.7	46.4	48.1
Medium	Between 300,000 and 1,000,000	7.2	12.0	4.4	7.2	12.1	11.7	60.7	59.9
Small Medium	Between 50,000 and 300,000	9.6	15.4	6.8	10.5	30.0	30.8	71	68.1
Small	Less than 50,000	8.4	15.8	7.3	13.3	31.8	35.7	86.9	84.1
<i>of which:</i>									
	Between 10,000 and 50,000	9.2	17.5	7.8	14.4	...	...	84.9	82.1
	Less than 10,000	6.8	12.1	6.2	10.8	...	...	91.3	88.9

Source: Federal Treasury.

Appendix Table 4. **Descriptive statistics**

	Mean	Std. dev.	Max	Min	No. obs.
A. State-level dataset					
Enrolment rate (in per cent)	92.3	5.3	99.4	70.8	130
Per capita GDP (in <i>reais</i>)	4,655.9	2,444.9	14,636.1	1,479.3	130
Repetition rate (in per cent)	25.9	8.7	46.4	6.3	130
$\Delta education$	0.2	0.4	1.7	-0.6	130
FUNDEF transfer per student (in <i>reais</i>)	9.4	23.5	105.3	0.0	130
B. Municipality-level dataset					
Enrolment rate (in per cent, 2000)	94.5	3.8	99.9	65.3	4,305
Enrolment rate (in per cent, 1991)	75.0	12.4	97.0	28.1	4,305
Gini coefficient (1991)	0.5	0.1	0.8	0.3	4,305
Election (2000)	89.1	14.7	100.0	19.4	4,305
Spending on ducation (in <i>reais</i>)	2,032.8	1,879.7	14,529.2	302.7	4,305
distrib	0.6	0.1	1.0	0.3	4,305
Average transfer (in <i>reais</i>)	507.1	150.3	1,017.0	344.2	4,305

Source: ?? And OECD calculations.

APPENDIX 2: DEFINITION OF VARIABLES

The state-level dataset

34. The dataset includes the 26 states (excluding the Federal District) and six time periods (1991, 1994, 1998, 1999, 2000, and 2001). In particular:

- The net enrolment rate is defined as the percentage of children aged 7-14 who attend school or pre-school. Data are available from INEP (Ministry of Education) for 1991, 1994, 1998, 1999; from the EDUDATABRASIL database (Ministry of Education), for 2000; from the national household survey (PNAD), for 2001; and from IBGE (2003), for 2002.
- Per capita GDP is available from the IPEADATA database (Ministry of Planning and Budget) in constant *reais* of 2000. GDP per capita for 2001 was constructed using data from IBGE's national and regional accounts.
- The repetition rate is defined as the percentage of students that repeat a class within a given year. Information is available from INEP (Ministry of Education). The value for 1994 was not available and, therefore, the closest available data point (1995) was used instead.
- Spending per student under FUNDEF is available from the Ministry of Education for 1999-2001.
- The distribution coefficient under FUNDEF is the percentage of all students in primary and lower-secondary education that are enrolled in the state school network. Information is available for 1998-2001.
- Total municipal spending on education and culture (in constant *reais* of 2000) is available from the Ministry of Education for the post-1994 period.
- The value of federal top-up grants under FUNDEF is calculated by dividing the total transfers to each state by the number of enrolled students in each state. Data are available from the Ministry of Finance.

The municipality level dataset

35. The dataset covers at most 5 506 municipalities. Most data are available from IPEA (Ministry of Planning and Budget). The composition of the school network between the states and the municipalities is available from the Ministry of Education, as well as the number of students enrolled in primary and lower-secondary education. The amount of transfers under FUNDEF is defined in constant *reais* of 2000 and was averaged over the period 1998-2000. This variable is state-variant as transfers are allocated at the state level. Information is available from the Ministry of Education.

36. Due to missing data and to eliminate outliers, some extreme observations have been eliminated from the data set. These omissions include the municipalities with enrolment rate below 60 per cent in 2000 (5 observations), the municipalities where enrolment rates more than tripled between 1991 and 2000 (14 observations), and the municipalities with recorded spending on education above BRL 15 000 (73 observations) and below BRL 300 (50 observations).

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